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(54) Title: SELF-FOAMING MULTIFUNCTIONAL CLEANSING COMPOSITION WITH HYDROPHOBIC CARRIER (57) Abstract <p>A stable self-foaming cleansing composition including a surfactant; a compatible suspending agent; a suspensate, said suspensate including a hydrophobic carrier material that serves as a carrier for one or more hydrophobic active materials and at least one hydrophobic auxiliary active material incorporated in the hydrophobic carrier material; a lather-generating agent to provide self-lathering, and water.</p>		

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SELF-FOAMING MULTIFUNCTIONAL CLEANSING COMPOSITION WITH HYDROPHOBIC CARRIER

This invention relates to a novel stable, aqueous self-foaming cleansing composition. More particularly, this invention relates to a stable self-foaming cleansing composition incorporating a self-foaming agent, an active suspensate comprising a hydrophobic carrier material and at least one hydrophobic auxiliary active material incorporated in the carrier material, and low levels of a surface active agent.

There are many cleansing products for personal and home use for example shampoos, skin cleansers, soaps and hard surface cleaners. The products can take the form of a liquid, a gel or paste of various viscosities. These products have various amounts of various essential and optional ingredients or components selected for their intended function or use. One of the principal components in most cleansing products is a surfactant. Surfactants are used to remove dirt and debris and also to impart a foaming characteristic to the cleansing product which gives the consumer a perceived indication that the product is functioning as a cleanser. In addition to a surfactant, some cleansing products may contain an active ingredient, to impart a secondary function to the product. However, these additional ingredients tend to suppress the foaming action of surfactants.

In recent years, there have been attempts to incorporate higher levels of active ingredients into a surfactant-based product formulation to give the consumer the benefit of having one product with dual functions, for example, a shampoo with conditioner. These dual function products are sometimes referred to as "two-in-one" or "2-in-1" products because there is an auxiliary active component and a surfactant, or blend of surfactants, in one formulation. In these systems, the surfactant is combined with a hydrophobic auxiliary active ingredient to provide conditioning. The object of 2-in-1 products is to optimize the deposition of the hydrophobic auxiliary active component onto the surface to be cleaned while maintaining both the maximum cleaning and lathering properties of the formulation.

As aforementioned, the problem with trying to combine an active component into a surfactant-based formulation has to do with competing functions of ingredients, that is, the use of one or more hydrophobic auxiliary active materials in a formulation may suppress the foaming characteristic of the surfactant. This occurs when the hydrophobic auxiliary active material modifies the property of the surfactant solution such as by changing the surface tension of the solution or the interfacial tension between the surfactant solution and the entrapped gas. It may also occur due to a reaction or complexation of the surfactant and the hydrophobic auxiliary active material which lowers the amount of surfactant available. Thus, when a hydrophobic auxiliary active, such as dimethicone, or a mineral or vegetable oil, is used in a formulation, normally the amount of surfactant in the formulation is increased so that the formulation will provide a level of foaming and cleansing which is acceptable to the consumer. However, in prior art formulations, as the amount of surfactant used in the

formulation is increased, the lower the amount of hydrophobe which is deposited onto a surface. Thus, at high levels of surfactant, the beneficial effect of the hydrophobic auxiliary active is lost. Conversely, if the level of surfactant is maintained then the level of the hydrophobic component must be lowered and, again, the beneficial effects of the hydrophobic auxiliary is lost.

Even so, current 2-in-1 products simply cannot contain low levels of surfactant because without employing a certain high level of surfactant, the 2-in-1 products known in the prior art would not produce consumer-acceptable lather. Therefore, there must be a compromise between the amount of surfactant used and the amount of hydrophobic auxiliary actives used in a surfactant-based formulation in order to obtain the maximum beneficial effect from both the foam-producing surfactant and the active used.

In addition, high levels of the most efficient cleansing surfactants may produce either a skin irritation or damage to the surface to which it is applied. They may also be difficult to rinse completely which can produce a sticky or tacky film on the surface resulting in consumer dissatisfaction. Thus, there is a practical limit to the amount of surfactant one can use in products which will contact the skin of consumers or the surface to be cleaned in order to minimize the detrimental effect.

In order to provide the best possible cleansing composition, it would be desirable to maximize the amount of hydrophobic auxiliary active ingredient in a surfactant-based formulation which translates to maximum deposition of the hydrophobic auxiliary active ingredient on a surface to be cleaned while maintaining the required amount of surfactant necessary to obtain an acceptable foaming and cleansing product for a consumer.

It has been unexpectedly found that by adding a self-foaming agent to a surfactant-based formulation having at least one active ingredient, the surfactant levels required to obtain a consumer-acceptable foam is reduced providing a mechanism for increasing the amount of hydrophobic auxiliary active ingredient in the formulation without detrimentally affecting the foaming characteristics of the formulation.

It has further been advantageously found that by increasing the hydrophobic auxiliary active, the benefit that the hydrophobic auxiliary active provides to the substrate can be intensified or modified by other hydrophobic ingredients which are mutually soluble or dispersible in the hydrophobic auxiliary active. In other words, the hydrophobic auxiliary active of the present invention can be used as a vehicle or a delivery system to co-deposit additional active materials thus providing a multitude of benefits that were not possible with previous 2-in-1 cleansers that contained lesser amounts of hydrophobic components.

Although not to be limited thereby, one aspect of the present invention is to advantageously use the hydrophobic auxiliary active to deliver to a substrate, other oil soluble or oil dispersible hydrophobic auxiliary active materials such as quaternary ammonium compounds, therapeutic agents or surface treatment products. Oil soluble or oil dispersible

quaternary ammonium compounds are typically used to control static charge build-up or to neutralize the inherent charge on certain surfaces such as hair, skin, glass and other surfaces. On hair, for example, they provide easy wet comb and reduce the interfiber electrostatic repulsion that can cause fly away and lack of control, however, they are not normally
5 compatible with the anionic surfactants found in conventional shampoos. On other surfaces they can act as anti-redeposition agents to minimize the attraction of dirt or dust to the surface.

Another aspect of the present invention is to use the hydrophobic auxiliary active to deliver a therapeutic agent such as a sunscreen or antiinflammatory agent to a
10 substrate.

In yet another aspect of the present invention, the hydrophobic auxiliary active can be used to carry a surface modifying agent such as an oil soluble polymer to a substrate.

Without limiting the utility of the present invention, it should become apparent that the compositions of the present invention can provide cleansing and effective multiple
15 auxiliary benefits to a surface in a single product. For example, hair care compositions can be prepared such that they not only provide improved conditioning from a foaming or cleansing system, but can simultaneously provide hold, style retention and manageability as well.

In accordance with the present invention, there is provided a self-foaming cleansing composition including a surfactant; a compatible suspending agent; a suspensate
20 which comprises a hydrophobic carrier material and a hydrophobic auxiliary active material incorporated into said hydrophobic carrier material, the suspensate adapted to be deposited onto a surface to be cleaned; a lather-generating agent to provide self-lathering; and water.

The present composition enables the use of low surfactant levels thereby reducing irritation or damage yet maximizing the deposition of the suspensate and its
25 contents to maximize functionality. While the present invention is not limited to any specific theory of action, it should be of interest and may be helpful in understanding the present invention, if the following explanation is offered for the surprising discovery that reduced levels of surfactant are possible for surfactant-based formulation and still maintaining acceptable levels of foam and cleansing.

30 In a conventional surfactant-based cleansing system, the foam is generated by the entrapment of air from the surrounding atmosphere. This is accomplished by creating sites of nucleation for the air in the surfactant-based liquid. Typically, the mechanical action of rubbing the hands together, or rubbing the hands on the hair, or rubbing a sponge or brush on a surface will provide suitable sites of nucleation and consequently will generate a foam.
35 The quality and quantity of the foam produced is dependent on the nature and dilution of the surfactant, the type and amount of mechanical action and the presence of dirt, oil or other matter on the surface that can modify the foam.

The addition of an auxiliary active, such as a hydrophobic oil, will usually reduce the ability of the surfactant-based system to generate a foam. Consequently, more surfactant is needed in conventional surfactant-based cleaning systems to achieve the same level of perceived cleaning by the system.

5 However, if a foam-generating agent is added to the surfactant base, little or no mechanical action is needed to produce an acceptable foam. The release of the entrapped foaming agent results in self-nucleation of a bubble in the surfactant solution. Further, the lather forming abilities of a system with a self-foaming agent is so efficient that the level of surfactant can be greatly reduced without affecting the quality or quantity of foam produced.

10 Analogously, if a hydrophobic auxiliary active component is added to the surfactant base, the presence of the self-foaming agent can overcome the foam-suppressing effect of the hydrophobic auxiliary active component on the primary surfactant or blend of surfactants. As a result of a self-foaming agent being present in a composition, higher levels of hydrophobic auxiliary active can be incorporated into the cleansing system without
15 reducing the quality or quantity of lather produced. In fact, the level of primary surfactant in the composition can be greatly reduced without adversely affecting the foaming properties of the composition resulting in a greater deposition of the hydrophobic auxiliary active component or components.

 It is one of the objectives of the present invention to provide a novel surfactant-based multifunctional formulation, for example, a 2-in-1 formulation, containing a self-foaming agent useful for a wide range of cleansing products. The composition of the present invention delivers more functional materials than conventional 2-in-1 products due to the
20 lower surfactant levels and due to incorporation of benefit enhancing agents into the hydrophobic carrier material. The lower surfactant levels are also less harsh to skin and hair
25 and other surfaces.

 Another object of the present invention is to provide a composition that imparts an effective level of multiple benefits to a surface to be cleaned, for example, a 3-in-1 hair care formulation, containing one or a combination of surfactants, a self-foaming agent, and an auxiliary active ingredient that will provide hold, style retention and manageability in
30 addition to conditioning from a foaming composition which is intended to be rinsed out of the hair.

 Still another object of the present invention is to provide a composition which deposits effective levels of a therapeutic agent onto a surface to be cleaned, for example, sunscreen protection with moisturization or conditioning benefits from a hair or skin cleanser.

35 It is the further object of the present invention to provide a composition which delivers an effective level of one or more surface modifying agents onto a surface to be cleaned, for example, an oil soluble water-proofing polymer (with or without a sunscreen

molecule) from a conditioning hair or skin cleanser with a sunscreen molecule from a conditioning hair or skin cleanser.

In its broadest scope, the present invention is a stable, homogeneous, self-foaming composition which includes, as essential components, water; an effective amount of a suitable surfactant adapted to provide the required cleansing and foaming properties to the composition; an effective amount of a selective suspending agent adapted to suspend an active suspensate which is to be deposited on a surface to be cleaned; an effective amount of a selective suspensate adapted to function as its intended use; and an effective amount of a selective self-foaming agent adapted to provide the resultant composition with self-lathering properties.

By "stable" it is meant that the composition of the present invention remains suitably homogeneous, that is, free from separation, flocculation, creaming or syneresis, to deliver the desired performance properties throughout the adequate shelf-life for the product under typical storage conditions. Normally this could be two years or more to permit standard distribution and inventory practices.

By "self-foaming" or "self-lathering" it is meant that little to no mechanical action is needed to produce a consumer acceptable level of foam.

By "homogeneous" it is meant uniform in structure or composition throughout.

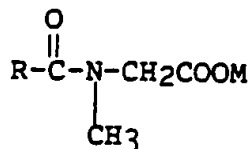
Water is an essential component of the composition of the present invention because it serves as a diluent and/or a solvent for the entire matrix, and allows the suspending agent to stabilize the suspensate(s) of the composition. Water from any source, including, for example, tap water, distilled water and deionized water is suitable for use in the present invention provided any retained elements in the water do not interfere with the functionality of the other components of the composition. The amount of water in the total composition ultimately is determined by the amount of the other essential and optional ingredients included in the composition. Preferably demineralized water is used. Generally, the water used is from 1.0 percent to 99 percent by weight. Preferably, from 35 percent to 95 percent by weight of the composition should be water and, more preferably, from 60 percent to 90 percent by weight of the total composition should be water.

The composition of the present invention includes as an essential constituent at least one or more surface active agents (surfactants). These materials reduce the surface tension of water and create a suitable interfacial tension between the water and particulate matter, oil and gases having a positive absolute vapor pressure at use conditions so as to generate foam and remove dirt and debris from the surface. The surfactant used in the composition of the present invention can be for example an anionic, nonionic, amphoteric (zwitterionic), cationic or mixtures thereof.

Suitable anionic surfactants include alkyl and alkyl ether sulfates, or combinations thereof. These surfactants have the respective formula ROSO_3M and

$RO(C_2H_4O)_xSO_3M$ wherein R is an alkyl or alkenyl radical of preferably 8 to 22 and, more preferably 10 to 18 carbon atoms, x is 0 to 10 and M is a water-soluble cation such as ammonium, sodium, potassium, and triethanolamine.

Other suitable anionic surfactants include acyl sarcosines derived from natural fatty acids and amino acid sarcosine (N-methyl glycine) of the following general formula:



where R is a fatty acid hydrocarbon chain from 10 to 20 carbon atoms, and M is a water-soluble cation such as ammonium, sodium, potassium triethanolamine, and other cations. Common derivatives include lauroyl, myristoyl, oleoyl, and stearoyl sarcosinates.

Other suitable anionic surfactants include alkyl and alkylbenzene sulfonate, succinates, sulfoacetates, and sulfosuccinates having from 8 to 24 carbon atoms. Suitable derivatives include the ammonium, sodium, potassium, and triethanolamine salts thereof.

Nonionic synthetic detergents can be broadly defined as compounds produced by the condensation of alkylene oxide groups (hydrophilic in nature) with an organic hydrophobic compound, which can be aliphatic or alkyl aromatic in nature. The length of the hydrophilic or polyoxyalkylene radical which is condensed with any particular hydrophobic group can be readily adjusted to yield a water-soluble compound having the desired degree of balance between hydrophilic and hydrophobic elements. Another class has semi-polar characteristics. Classes of nonionic synthetic detergents are as follows:

(a) The monoethanol, diethanol, and ammonia amides of fatty acids having an acyl moiety of from 8 to 18 carbon atoms. These acyl moieties are normally derived from naturally occurring glycerides, for example, coconut oil, palm oil, soybean oil and tallow, but can be derived synthetically, for example, by the oxidation of petroleum, or by hydrogenation of carbon monoxide by the Fischer-Tropsch process.

(b) A class of nonionic synthetic detergents under the trade name of Pluronic®. These compounds are formed by condensing ethylene oxide with a hydrophobic base formed by the condensation of propylene oxide with propylene glycol. The hydrophobic portion of the molecule which, or course, exhibits water insolubility, has a molecular weight of from 1500 to 1800. The addition of polyoxyethylene radicals to this hydrophobic portion tends to increase the water solubility of the molecule as a whole and the liquid character of the product is retained up to the point where the polyethylene content is about 50 percent of the total weight of the condensation product.

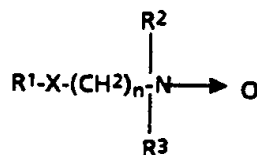
(c) The polyethylene oxide condensates of alkyl phenols, for example, the condensation products of alkyl phenols, having an alkyl group containing from 6 to 12 carbon atoms in either a straight chain or branched chain configuration with ethylene oxide, the said

ethylene oxide being present in amounts equal to 5 to 25 moles of ethylene oxide per mole of alkyl phenol. The alkyl substituent in such compounds may be derived from polymerized propylene, diisobutylene, octene, or nonene, for example.

(d) Those nonionic synthetic detergents derived from the condensation of ethylene oxide with the product resulting from the reaction of propylene oxide and ethylene diamine. For example, compounds containing from 40 percent to 80 percent polyoxyethylene by weight and having a molecular weight of from 5,000 to 11,000 resulting from the reaction of ethylene oxide groups with a hydrophobic base constituted of the reaction product of ethylene diamine and excess propylene oxide.

(e) The condensation product of aliphatic alcohols having from 8 to 22 carbon atoms, in either straight chain or branched chain configuration, with ethylene oxide, for example, a coconut alcohol ethylene oxide condensate having from 5 to 30 moles of ethylene oxide per mole of coconut alcohol, the coconut alcohol fraction having from 10 to 14 carbon atoms.

(f) Long chain tertiary amine oxides corresponding to the following general formula:



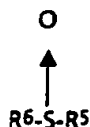
wherein R¹ is an alkyl or acyl radical of from 8 to 24 carbon atoms, R² and R³ are each methyl, ethyl or hydroxyethyl radical, X is either a O atom or an -NH- and n equal from 0 to 10. The arrow in the formula is a conventional representation of a semi-polar bond. Specific examples of amine oxide detergents include dimethyldodecylamine oxide; cetyldimethylamine oxide; bis-(2-hydroxyethyl) dodecylamine oxide; cocamidopropyl dimethylamine oxide and bis-(2-hydroxyethyl)-3-dodecoxy-1-hydroxypropyl amine oxide.

(g) Long chain tertiary phosphine oxides, corresponding to the following general formula:



wherein R is an alkyl, alkenyl or monohydroxyalkyl radical ranging from 10 to 24 carbon atoms in chain length, and R' and R'' are each alkyl or monohydroxyalkyl groups containing from 1 to 3 carbon atoms. The arrow in the formula is a conventional representation of a semi-polar bond. Examples of suitable phosphine oxides are found in U.S. Pat. No. 3,304,262 issued February 14, 1967 and include: dimethyldodecylphosphine oxide; diethyldodecylphosphine oxide; dimethyl-(2-hydroxydodecyl) phosphine oxide.

(h) Long chain sulfoxides having the general formula:



wherein R⁵ is an alkyl radical containing from 10 to 28 carbon atoms, from 0 to 5 ether linkages and from 0 to 2 hydroxyl substituents, at least one moiety of R⁵ being an alkyl radical containing 0 ether linkages and containing from 10 to 18 carbon atoms, and wherein R⁶ is an alkyl radical containing from 1 to 3 carbon atoms and from one to two hydroxyl groups. Specific examples of these sulfoxides are: dodecyl methyl sulfoxide; 3-hydroxy tridecyl methyl sulfoxide; 3-methoxy tridecyl methyl sulfoxide; and 3-hydroxy-4-dodecoxybutyl methyl sulfoxide.

Amphoteric synthetic detergents can be broadly described as derivatives of aliphatic secondary and tertiary amines, in which the aliphatic radical may be straight chain or branched and wherein one of the aliphatic substituents contains from 8 to 18 carbon atoms and one contains an anionic water solubilizing groups, for example, carboxy, sulfo, sulfato, phosphato, or phosphono. Examples of compounds falling within this definition are sodium-3-dodecylamino-propionate and sodium-3-dodecylaminopropane sulfonate.

Zwitterionic synthetic detergents can be broadly described as derivatives of aliphatic quaternary ammonium, phosphonium, and sulfonium compounds, in which the aliphatic radical may be straight chain or branched, and wherein one of the aliphatic substituents contains from 8 to 18 carbon atoms and one contains an anionic water solubilizing group, for example, carboxy, sulfo, sulfato, phosphato, or phosphono. Examples of compounds falling within this definition are 3-(N,N-dimethyl-N-hexadecylammonio) propane-1-sulfonate and 3-(N,N-dimethyl-N-hexadecylammonium)-2-hydroxypropane-1-sulfonate.

Cationic detergents include those having the formula $\text{R-N(R}^2\text{)}_3(\text{+})_x(\text{-})$ wherein R is an alkyl chain or the residue formed from a fatty acid and a diamine such as N,N-dimethyl-1,3-isopropane diamine, containing from 8 to 20 carbon atoms, each R² is selected from the group consisting of alkyl and alkanol groups containing from 1 to 4 carbon atoms and benzyl groups there being normally no more than one benzyl group and two R² groups can be joined by either a carbon-carbon ether, or imino linkage to form a ring structure, and X represents a halogen atom, sulfate group, nitrate group or other pseudohalogen group. Specific examples are coconut alkyl trimethyl amine chloride, dodecyl dimethyl benzyl bromide, and dodecyl methyl morpholino chloride.

Other cationic detergents that are particularly useful include protonated fatty amines represented by the formula $\text{R-N(R}^2\text{)}_2\text{H(+)}_x(\text{-})$ wherein R is an alkyl chain or the residue formed from a fatty acid and a diamine containing 8 to 20 carbon atoms, each R² is selected from the group consisting of alkyl and alkanol groups containing 1 to 4 carbon atoms and

groups can be joined by either an ether or an imino linkage to form a ring structure, and X represents, for example, a halogen, sulfate group, nitrate group, acetate or lactate to balance the charge and is the conjugate base of the acid used to protonate the amine.

The surfactant is present in the composition of the present invention in an effective amount to reduce the surface tension of water and to create a suitable interfacial tension so as to cleanse the surface of materials not normally removed by water alone and to generate a suitable foam. The amount of surfactant used in the composition of the present invention should be sufficient to provide the desired cleansing and foaming. Below the preferred amounts discussed herein below, the composition will not provide adequate cleaning and foaming. Above the preferred amounts, the amount of surfactant will be too high and the deposition of the active ingredient will not be sufficient. Furthermore, too high levels of surfactant will irritate the skin of a consumer or degrade the surface the composition is applied to. In addition, use of any of the ingredients in the present invention above the preferred amounts would not be economical.

Generally, the surfactant is present in the composition in an amount of from 0.001 percent to 50 percent by weight of the composition. Preferably, the surfactant is present in an amount of from 0.01 percent to 10 percent by weight based on the weight of the composition. More preferably, the surfactant is present in an amount of from 0.1 percent to 5 percent by weight based on the total weight of the composition. It has been found that even at the above low levels the formulation generates sufficient foam acceptable to the consumer.

A nonionic, anionic, cationic or amphoteric surfactant, may be used alone, in the composition of the present invention; or two or more surfactants may be used as a mixture, the surfactants selected from anionic, nonionic, cationic, and amphoteric surfactants to provide the composition of the invention. Numerous surface active agents or surfactants, suitable for use in the present composition, are described in detail in McCutcheon's "Emulsifiers and Detergents", 1991 and in U.S. Patent Nos. 3,723,357; 3,964,500; 4,364,837; 4,491,539; 4,678,606 and 4,788,006. Preferred examples of anionic surfactants useful in the present invention include ammonium lauryl sulfate, ammonium cocoyl isethionate, sodium laureth-2 sulfate, TEA-lauryl sulfate, ammonium laureth 2 sulfate, sodium laureth-13 carboxylate, sodium lauryl sarcosinate, sodium methyl cocoyl taurate, sodium lauroyl lactylate, sodium dodecyl benzene sulfonate, potassium coco-hydrolyzed animal protein sodium C₁₂-C₁₄ olefin sulfonate, sodium cocoyl glutamate, and disodium cocamido MEA-sulfosuccinate. Preferred examples of nonionic surfactants useful in the present invention include lauramide DEA, cocamide MEA, PEG-7 glyceryl cocoate, and dimethicone copolyol. Preferred examples of cationic surfactants useful in the present invention include isostearyl ethyldimonium ethosulfate, PEG-10 stearamine, and cocoyl benzyl hydroxyethyl imidazolinium chloride. Preferred examples of amphoteric surfactants useful in the present invention include lauroamphodiacetate and sodium C₁₂-C₁₅ alkoxypropyl iminodipropionate.

The composition of the present invention includes at least one suspensate which is hydrophobic, and which is insoluble and suspendable in the formulation of the present invention. The suspensate functions as a carrier for a hydrophobic auxiliary active ingredient which is incorporated into the body of the suspensate. The suspensate is the component of the present composition which is to be deposited onto a surface to provide the auxiliary benefit or benefits to the surface. The composition of the present invention is referred to as "multifunctional" because a plurality of active suspensates can be incorporated into the composition to provide several benefits to a surface. The suspensate may also be "multifunctional" because a plurality of auxiliary actives can be incorporated into the suspensate to provide a plurality of benefits.

Thus, the "suspensate" of the present invention comprises a combination of at least two components A and B, wherein component A is a hydrophobic carrier material and component B is a hydrophobic auxiliary active ingredient incorporated or embedded into (that is, carried by) the carrier material (component A). If desired, the carrier material may function only as a carrier material for one or more auxiliary actives. However, in a preferred embodiment of the present invention, the hydrophobic carrier material may also be an auxiliary active ingredient itself and therefore, in this instance, the hydrophobic carrier material has two functions: (1) to provide an auxiliary benefit, and (2) to serve as a carrier for other auxiliary actives.

The suspensate suspended in the aqueous continuous phase of the present composition is in the form of a discrete particle. Since the suspensate serves as a carrier for auxiliary actives, the suspensate with the auxiliary actives contained in the suspensate is essentially a particle which may be (1) a mixture of two or more soluble or miscible liquids; (2) a mixture of a solid soluble in a liquid, (3) a mixture of a solid particle dispersed in a liquid or (4) a combination of (1), (2) and/or (3) above. The suspensate can also be in the form of a plurality of discrete particles selected from (1)-(4) above.

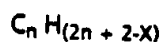
The suspensate used in the composition of the present invention is preferably compatible with the other ingredients present in the continuous phase of the composition. By "compatible" it is meant that the suspensate does not interact with the remaining components of the composition in such a manner as to inactivate the properties of the composition or cause the composition to become unstable. The individual components of the suspensate, on the other hand, may or may not be compatible with the other ingredients in the continuous phase. However, when the individual components are mixed together to form the suspensate, the suspensate is compatible with the other ingredients in the continuous phase of the composition.

The suspensate used in the present invention is generally a water insoluble material. The hydrophobic carrier material, component A of the suspensate, employed in the present invention, includes, for example, low to non-polar liquids that can preferably also serve

as an auxiliary active. The carrier material can also be, for example, an oil, low melting wax or paste. The hydrophobic auxiliary active, component B of the suspensate, includes, for example, auxiliary actives which are soluble, miscible or dispersible in the carrier material. The auxiliary active may include, for example, a liquid, solid, oil, low melting wax or paste.

5 Components A and B of the suspensate, described herein below, can be of the same class of compounds, provided that once component A is selected as the hydrophobic carrier for the suspensate, component B must be a different component. The auxiliary active, component B of the suspensate, is chosen to provide an improved or additional benefit than the carrier material would provide when used alone.

10 Suitable materials used as the hydrophobic carrier material that can be suspended in the composition of the present invention can be described by the following formula:



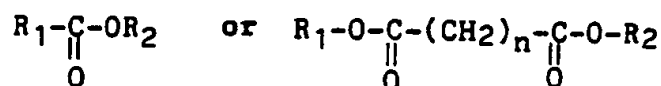
where n is an integer from 3 to greater than 1 million and x is 0 or an even integer no greater than n.

15 These hydrophobic carrier materials include, for example, saturated, unsaturated, branched and cyclic hydrocarbon chains. Examples of the hydrophobic carrier materials include, for example, mineral oil, petrolatum, Permethyl™ Fluids, and polybutenes.

Other useful hydrophobic carrier materials useful in the present invention, include, for example, the mono, di, tri or poly alkyl esters or ethers of di, tri or polyhydroxy
20 compounds such as ethylene glycol, propylene glycol, glycerin, sorbitol or polyol. An example of a particularly useful ester being propylene glycol monisostearate.

The hydrophobic carrier materials can also include, but are not limited to the following: branched, saturated or unsaturated vegetable oils such as soybean oil, babassu oil, castor oil, cottonseed oil, Chinese tallow oil, crambe oil, perilla oil, Danish rapeseed oil, rice
25 bran oil, palm oil, palm kernel oil, olive oil, linseed oil, coconut oil, sunflower oil, safflower oil, peanut oil, and corn oil. Preferred saturated and unsaturated vegetable oils are those having fatty acid components with 6 to 24 carbon atoms. An example of a preferred hydrophobic carrier material is peanut oil.

Additional oily hydrophobic carrier materials include, for example, esters of the
30 type described by the following general formula:



wherein R₁ and R₂ are saturated, unsaturated, branched or cyclic alkyl radicals of 2 to 24 carbon
35 atoms and n is an integer from 0 to 20. Suitable esters include isopropyl palmitate and diisopropyl adipate.

The hydrophobic carrier material of the present composition may also comprise a silicone material to deliver some measure of auxiliary benefit such as lubrication or shine. The

silicone material is preferably insoluble in water. Suitable water-insoluble silicone materials include polyalkylsiloxanes, polyarylsiloxanes, polyalkylarylsiloxanes, polysiloxane gums, and polyethersiloxane copolymers. Also useful according to the present invention are amino functional polydimethylsiloxanes such as Dow Corning 536 Fluid which is sold by Dow Corning Corporation. Teachings directed to suitable silicone materials useful in the present invention are found in U.S. Patent Nos. 3,208,911; 3,964,500; 4,152,416; 4,341,799; 4,364,837; 4,465,619, and 4,788,006.

Other suitable materials that can be used as the hydrophobic carrier material in the current composition are of the type described by the following general formula:



where R_1 is a saturated, unsaturated, branched or cyclic alkyl radical from C_2 to C_{24} ; $\text{M}^{(+)}$ is defined by the following formula:



where R_2 , R_3 and R_4 are hydrogen or a saturated, unsaturated or branched alkyl or hydroxyalkyl radical from C_1 to C_{10} ; R_5 is a saturated, unsaturated, branched or cyclic alkyl or substituted alkyl radical from C_8 to C_{24} .

An example of the above is lauramine oleate.

Another class of suitable hydrophobic carrier material used in the present invention may be, for example, water-insoluble homopolymers of propylene oxide, butylene oxide or higher ethylene oxides as well as the water-insoluble copolymers thereof including those with ethylene oxide. These copolymers can be either random or block polymers. Examples of homogeneous polymers include polypropylene oxide and polybutylene oxide. Typically, the molecular weight of these materials is between 100 and 10,000 daltons. Additionally, these materials can be condensed with a mono or polyhydroxyalkyl alcohol as exemplified by the UCON fluids from the Union Carbide Chemical Company.

Other useful hydrophobic carrier materials used in the present invention include, for example, water-insoluble non-polar liquids. The water-insoluble non-polar liquid useful as the hydrophobic carrier material may be, for example, a substantially water-insoluble, nonvolatile silicone oil. The silicone oil includes, for example, polyalkylsiloxanes, polyarylsiloxanes, polyalkylarylsiloxanes, polysiloxane gums, dihydroxypolysiloxane, and polyethersiloxane copolymers. The water-insoluble non-polar liquid may also be an ester, such as a glyceride, for example, peanut oil, or a simple ester, for example, butyl stearate or C_{12} - C_{15} alcohols benzoate which is sold under the tradename Finsolv TN by Finetex, Inc.

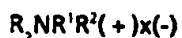
Still other useful hydrophobic carrier materials useful in the present invention include, for example, completely halogenated hydrocarbons containing 2 carbon atoms such as

1,1,2-trichloro-trifluoroethane. Other organic liquid compounds useful here are described in U.S. Patent No. 4,744,979.

The hydrophobic auxiliary active material, Component B of the suspensate of the present invention which is carried by Component A, can include all of the materials listed above for Component A, provided that once Component A is chosen as a carrier, Component B has to be different in order for the overall composition to be within the scope of the present invention.

A class of suitable hydrophobic auxiliary actives, Component B of the suspensate, used in the present invention are oil soluble or oil dispersible quaternary ammonium compounds. Useful materials in this category are bis(isostearamidopropyl)-2-hydroxy-N1,N1,N3,N3-tetramethylpropadimonium chloride which is sold under the tradename Schercoquat 2IAP by Scher Chemicals, Inc., and 1-ethylene-bis(2-tallow-1-methylimidazolinium) methosulate which is sold under the tradename Varisoft 6112 by the Sherex Chemical Company, Inc.

Other oil soluble or oil dispersible quaternary ammonium compounds useful in the present invention are represented by the following formula:



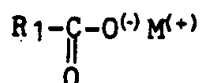
wherein each R is an alkyl chain or the residue formed from a fatty acid and a diamine containing 8 to 20 carbon atoms, each R² is selected from the group consisting of alkyl and alkanol groups containing 1 to 4 carbon atoms and groups, and X represents a halogen, sulfate group, nitrate group, and other pseudohalogen groups. The preferred quaternary ammonium compounds used in the present invention are those wherein R¹ is equivalent to R, a specific example of such a compound being tricetylmethylammonium chloride. The most preferred oil soluble or oil dispersible quaternary ammonium compounds used in the present invention are those wherein R¹ is equivalent to R², specific examples of such compounds including dibehenyl dimethylammonium chloride, dibehenyl dimethylammonium methosulate, dicocodimethylammonium chloride, N,N-bis(hydrogenated tallow) dimethylammonium chloride, and N-(2-hydroxyethyl)-N,N-bis(tallowamidoethyl) methylammonium chloride. The ratio of the oil soluble or oil dispersible quaternary ammonium compound to the hydrophobic carrier material used in the composition of the present invention is from 1:20 to 20:1, preferably the ratio is from 1:10 to 10:1, most preferably the ratio is from 1:4 to 4:1.

Yet, another class of suitable hydrophobic auxiliary actives used in the present invention are oil soluble or oil dispersible polymers or their amine salts such as acrylates/octylpropenamide copolymer which is sold under the tradename Dermacyl LT by National Starch and Chemical Company, acrylates/octylacrylamide copolymer which is sold under the tradename Dermacyl 79 by National Starch and Chemical Company, long-chain alpha-olefin/vinyl pyrrolidone copolymer wherein the alpha-olefin contains from 4 to 50 carbon atoms sold under the trademark GANEX® by International Specialty Products, polyvinyl

methylether/maleic anhydride copolymer sold under the trademark GANTREZ® by the International Specialty Products, and acrylates crosspolymer which is sold under the tradename Carboset by the B. F. Goodrich Company. Another useful oil dispersible polymer used in the present invention is aluminum starch octenyl succinate sold under the tradename Dry Flo-PC by National Starch and Chemical Company. Suitable non-neutralizable oil soluble or oil dispersible polymers used in the present invention include phenyl propyl silsesquioxanol which is supplied by the Dow Corning Corporation as Dow Corning X1-0421 Resin. The ratio of the oil soluble or oil dispersible polymer to the hydrophobic carrier material used in the composition of the present invention is from 1.20 to 20.1 preferably the ratio is from 1:10 to 10:1 and most preferably the ratio is from 1:4 to 4:1.

Particulate solids can also be used as the hydrophobic auxiliary actives which can be suspended in the hydrophobic carrier of the suspensate used in the composition of the present invention. A nonlimiting example of such solids includes the antidandruff agents selenium disulfide, sulfur, and compounds of pyrithione, especially zinc pyrithione.

Other suitable materials that can be used as the hydrophobic auxiliary active in the suspensate of the present composition are of the type described by the following general formula:



where R₁ is a saturated, unsaturated, branched or cyclic alkyl radical from C₂ to C₂₄; M⁽⁺⁾ is defined by the following formula:



where R₂, R₃ and R₄ are hydrogen or a saturated, unsaturated or branched alkyl or hydroxyalkyl radical from C₁ to C₁₀; R₅ is a saturated, unsaturated, branched or cyclic alkyl or substituted alkyl radical from C₈ to C₂₄; or M⁽⁺⁾ is a lithium or polyvalent metal ion, for example, calcium, magnesium, aluminum and zinc. Examples of the above materials include zinc stearate, magnesium stearate and lithium stearate.

Other materials that can be used as auxiliary hydrophobic materials are oil soluble dyes such as beta-carotene, canthaxanthin, D&C Violet #2, and D&C Red #17.

Other materials that can be used as auxiliary hydrophobic materials are therapeutic agents than can be found in the Merck Manual, published by Merck and Company, and the OTC Monographs published by the Food and Drug Administration in the Federal Register. These include, but are not limited to sunscreen compounds such as octyl methoxycinnamate, menthyl anthranilate, octocrylene and titanium dioxide; vitamins such as the tocopherols and vitamin A; counter-irritants such as methyl nicotinate, methyl salicylate and menthol; anti-inflammatory agents such as hydrocortisone and its derivatives; insect

repellents such as isomers of diethyltoluamide; anti-acne agents such as salicylic acid and benzoyl peroxide; and topically active hormones such as prednesone, pregnenolone succinate and pregnenolone acetate.

5 The amount of suspensate used in the composition should not be so low that no deposition of the active suspensate is obtained. Too high levels of suspensate may also provide an unstable composition or suppress the foaming characteristic of the composition. A hydrophobic suspensate is inherently a foam depressor as known in the prior art. However, it is surprisingly found that in the present composition, the suspensate functions so as to not suppress the foam at the preferred levels of use.

10 Generally, the suspensate is present in the composition in an amount of from 0.001 percent to 50 percent by weight of the composition. Preferably, the suspensate is present in an amount of from 0.01 percent to 30 percent by weight based on the weight of the composition. More preferably, the suspensate is present in an amount of from 0.1 percent to 10 percent by weight based on the weight of the composition.

15 The composition of the present invention includes at least one or more suspending agents which serves to stabilize the suspensate in the surfactant solution. It also serves, as a secondary function, to modify viscosity of the system to improve the flow and spreading properties of the composition. The suspending agent used in the composition of the present invention can be, but is not limited to, for example a modified polysaccharide,
20 synthetic polymer or inorganic.

Suitable polysaccharide or polysaccharide derived suspending agents useful in the present invention include, for example, those of cellulosic polymers, guar gums, xanthan gums, locust bean gums, gum arabic starches, starch amyloses and alginates. Excellent teachings directed to polysaccharides and polysaccharide derivatives useful in the present invention are
25 seen in The Encyclopedia of Polymer Science and Engineering, 2 ed., vol. 7, pp. 589 to 613.

Useful polysaccharide or polysaccharide derivatives are those of the guar gums and guar gum derivatives. Guar gums include those of high molecular weight carbohydrates or polysaccharides made up of linked mannose and galactose units. The molecule may be a straight chain of mannose units linked to each other by means of beta (1-4) glycosidic linkages.
30 Galactose units may branch from alternate mannose units through alpha (1-6) linkages with the mannose units. Useful guar gums include derivatives of hydroxypropyl, hydroxyethyl, sodium carboxymethyl, and carboxymethylhydroxypropyl guar gums. Also useful in the present invention are cationic modified guar gums such as guar hydroxypropyltrimonium chloride which is sold as Cosmedia Gum C-261 from Henkel Corporation. Teachings directed to
35 guar gums are seen in U.S. Patent Nos. 4,678,606 and 4,491,539.

Other polysaccharide or polysaccharide derivatives are useful in the present invention include those of the cellulosic polymers such as methyl, ethyl, hydroxypropyl, hydroxyethyl, carboxymethyl, and carboxymethylhydroxypropyl cellulose. Also useful in the

present invention are hydrophobically modified polysaccharides such as cetyl hydroxyethyl cellulose which is sold as Natrasol Plus from the Aqualon Corporation.

A particularly useful polysaccharide is xanthan gum. This biosynthetic gum material is commercially available and is a heteropolysaccharide with a molecular weight of greater than 1 million. It is believed to contain D-glucose, D-mannose and D-glucuronate. It is partially acetylated with approximately 5.0 percent acetyl. This information and other is found in Whisler, Roy L., Editor, Industrial Gums - Polysaccharides and Their Derivatives, New York Academic Press, 1973.

Suitable polymeric suspending agents used in the composition of the present invention include, for example, carboxyvinyl polymers.

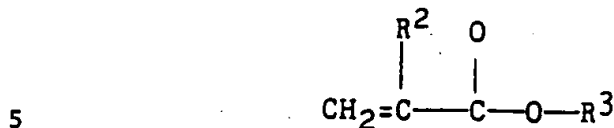
Carboxyvinyl polymers useful in the present invention have carboxylic acid monomer units derived from olefinically unsaturated carboxylic acid monomers containing at least one activated carbon-to-carbon olefinic double bond, and at least one carboxyl group. The olefinic double bond readily functions in polymerization because of its presence in the monomer molecule either in the alpha-beta position with respect to a carboxyl group or as a part of a terminal methylene grouping, that is, $\text{CH}_2<$. Olefinically unsaturated acids in this group include acrylic acids typified by the acrylic acid itself, methacrylic acid, ethacrylic acid, alpha-chloroacrylic acid, alpha-acrylic acid, beta methylacrylic acid (crotonic acid), alpha-phenyl acrylic acid, beta-acryloxy propionic acid, sorbic acid, alpha-chloro sorbic acid, angelic acid, cinnamic acid, p-chloro cinnamic acid, beta-styryl acrylic acid, itaconic acid, citraconic acid, mesaconic acid, glutaconic acid, aconitic acid, maleic acid, fumaric acid, and tricarboxy ethylene. As used herein, the term carboxylic acid includes anhydrides, as well as the polycarboxylic acids and those acid anhydrides, such as maleic anhydride, wherein the anhydride group is formed by the elimination of one molecule of water from two carboxyl groups located on the same polycarboxylic acid molecule.

Preferred carboxylic acid monomeric units employed in the present invention are derived from acrylic acid monomers having the following general structure:



wherein R^1 is a substituent selected from the class consisting of hydrogen, halogen, and the cyanogen ($\text{C} \equiv \text{N}$) groups, monovalent alkyl radicals of 1 to 4 carbons, monovalent aryl radicals of 6 to 14 carbons, monovalent alkaryl radicals of 7 to 12 carbons, and monovalent cycloaliphatic radicals of 4 to 8 carbons atoms. Of this class, acrylic, methacrylic, and ethacrylic acids are more preferred with acrylic acid being the most preferred. Another useful carboxylic monomer is maleic anhydride or the acid.

Suitable acrylic ester monomeric units useful in the present invention are derived from acrylic ester monomers having the formula:



where R is hydrogen, methyl or ethyl group and where R³ is an alkyl group having 10 to 30 carbon atoms, preferably 12 to 22 carbon atoms. Representative acrylic esters include decyl acrylate, isodecyl acrylate, lauryl acrylate, dodecyl acrylate, stearyl acrylate, and the corresponding methacrylates. Mixtures of two or more of the long chain acrylic esters can be successfully polymerized with one or more of the carboxylic acids.

The carboxyvinyl polymers have crosslinking monomeric units derived from polyfunctional vinylidene monomers containing at least two terminal CH₂-C< groups. Particularly useful crosslinking monomers are those polyalkenyl polyethers having more than one alkenyl ether group per molecule, and the most useful monomers have alkenyl groups in which an olefinic double bond is attached to a terminal methylene CH₂-C<. Such monomers can be prepared by the etherification of a polyhydric alcohol containing at least four carbon atoms and at least two hydroxyl groups. Products of such reactions are complex mixtures of polyethers with varying number of ether groups. It is preferred to use polyethers containing an average of two or more alkenyl ether groups per molecule. Other crosslinking monomers can also be used. Allyl pentaerythritol, trimethylolpropane diallylether, and allyl sucrose are exceptional crosslinking monomers for purposes herein.

The carboxyvinyl polymer preferably comprises from 95 to 99, and more preferably 96 to 98 weight percent of one or more of the carboxylic acid monomeric units and preferably 5 to 1, and more preferably 4 to 2 weight percent of one or more of the acrylic ester monomeric units. The carboxyvinyl polymer further preferably comprises a small proportion of the polyethylenically unsaturated crosslinking monomeric unit. The crosslinking monomeric unit is preferably from 0.1 to 1 and more preferably from 0.1 to 0.6 weight percent of the carboxyvinyl polymer. Preferred carboxyvinyl polymers useful to the present composition are Carbopol® 1342 and 1352; Pemulen® TR1 and TR2 (all of B.F. Goodrich & Co.). Carbopol® 1342 is most preferred.

Other vinylidene monomers can be used in place of the carboxylic acid in small amounts so long as the basic properties of the carboxyvinyl polymer such as thickening or a suspending are not adversely affected. examples include acrylonitrile, methacrylonitrile, acrylamide, methacrylamide, styrene, vinyl toluene, vinyl methyl ether, vinyl ethyl ketone, butadiene, vinyl acetate, methyl acrylate, butyl acrylate, cyanopropyl acrylate, methoxyethyl acrylate, chloroethyl acrylate, chloroethyl acrylate, vinyl chloride, vinylidene chloride, esters of

maleic and fumaric acid, bis (B-chloroethyl) vinyl phosphonates, and the like monomers that are known to those skilled in the art.

The carboxyvinyl polymers described herein have weight average molecular weights greater than about 500 to as high as several million. Molecular weight of such polymers is preferably in the range of 100,000 to 5 million.

Polymerization of the monomers may be carried out in the presence of a free radical catalyst in an inert atmosphere under pressure with proper agitation. Polymerization temperature may be varied from 0° to 125°C with polymerization between 25° to 90°C in presence of a free radical catalyst generally resulting in polymer yields of 75 to 100 percent. The monomers can be charged continuously or in batch during the course of polymerization or in any other conventional manner.

Useful free radical forming catalysts include, for example, peroxygen compounds such as sodium, potassium and ammonium persulfates, caprylyl peroxide, benzoyl peroxide, hydrogen peroxide, pelargonyl peroxide, cumene hydroperoxides, tertiary butyl diperphthalate, tertiary butyl perbenzoate, sodium peracetate, di(2-ethylhexyl)-peroxydicarbonate, and as well as azo catalysts such as azodiisobutyryl nitrile. Other useful catalysts include the so-called "redox" type of catalyst and the heavy-metal activated catalyst systems. Ultra-violet light may also be utilized as a source of free radicals. Although some systems polymerize solely by heat, catalysts generally provide better control.

Polymerization of the monomers is conducted in a solvent or an inert organic liquid in which the monomers are soluble but the resulting polymer is insoluble. The polymerization medium can be a mixture of suitable organic liquids or solvents. The product is preferably obtained as a very fine friable or fluffy precipitate. Typical solvents include hydrocarbons containing 6 to 8 carbon atoms such as benzene, tetraline hexane, heptane, and cyclohexane; chlorinated solvents such as carbon tetrachloride, chloroform, trichloroethylene, methyl chloride ethyl chloride, and methylene chloride; chlorofluoroalkanes such as chlorofluoromethane and chlorofluoroethane containing at least 4 halogen atoms; esters such as methyl acetate and ethyl acetate; and alcohols including, for example, methanol, ethanol and butanol. Amount of organic medium used, normally will be in excess of the monomers to be polymerized and the proportion may vary from at least 1 weight percent of monomers and 99 weight percent organic medium up to about 50 weight percent monomers and 50 weight percent medium.

The carboxyvinyl polymer preferably comprises between 0.1 to 1.5, more preferably between 0.8 and 1.0, and most preferably about 0.9 weight percent of the composition.

Excellent teachings directed to carboxyvinyl polymers useful in the present composition as well as methods of making are seen in U.S. Patent No. 4,686,254.

The carboxyvinyl polymer may function as both a thickener for the composition and as a suspending agent for the suspensate agent. The carboxyvinyl polymer is present in an amount sufficient to suspend and stabilize the suspensate. The carboxyvinyl polymer is further preferably present in an amount and the carboxyl groups thereof are partially or substantially
5 neutralized or esterified sufficient to thicken the composition to the desired level of thickening. The carboxyvinyl polymer is preferably 30 to 100 and more preferably 70 to 80 percent neutralized.

Suitable neutralizing agents for the carboxyvinyl polymer include those known in art as well as alkali anionic surfactants which provide the additional desired neutralizing effect.
10 The neutralizing agent may be an organic or inorganic substance having a basic moiety capable of partially or substantially neutralizing the carboxyvinyl polymer. Useful neutralizing agents are seen in U.S. Patent Nos. 3,330,731 and 3,590,005. Useful neutralizing agents include alkali and alkaline earth metal hydroxides; mono-, di-, and tri-aliphatic amines containing from 1 to 20 carbon atoms in the aliphatic carbon chain with the same or different substituent groups in
15 the di- and tri-compounds; and alkanolamines containing from 1 to 12 carbon atoms in the alkyl group. Suitable alkali metal hydroxides include, for example, those of sodium, potassium, and lithium. Suitable alkanolamines include, for example, mono-, di-, and tri-ethanolamines, ethanolamines, propanolamines, isopropanolamines. A most preferred neutralizing agent is triethanolamine. Also useful as neutralizing agents are the anionic acyl sarcosine surfactants
20 described above, which neutralize the carboxyvinyl polymer in addition to providing surface activity.

Other possible suspending agents useful in the present invention include, for example, alkali-soluble polymer emulsions such as Acrylates/Steareth-20 Methacrylate Copolymer, available as Aculyn™ 22 Thickener (Rohm and Haas Company). The use of this
25 material is described in the Aculyn Personal Care polymers formulation bulletin, FC-116, issued in 1990, available from Rohm and Haas. Other possible suspending agents include Di(Hydrogentated) Tallow Phthalic Acid Amide, available as Stepan TAB™-2 (Stepan Company). The use of the Stepan TAB-2 material is described in a product bulletin describing Stepan TAB™-2, available from Stepan Company. Other possible suspending agents include liquid
30 dispersions of sodium polyacrylate such as Sodium Polyacrylate Copolymer and Mineral Oil and PPG-1 Trideceth-6 available as Salcare SC91 (Allied Colloids). The use of the Salcare SC-91 material is described in a formulation and technical processing bulletin describing Salcare SC-91, available from Allied Colloids.

A suitable inorganic suspending agent useful in the present invention can be, but
35 is not limited to, magnesium aluminum silicate marketed as VEEGUM™ by the Vanderbilt Chemical Company.

The amount of suspending agent used in the composition of the present invention should not be so low that no suspension of the suspensate is obtained. Too high

levels of suspending agent would affect the processability of the composition or affect the resulting properties of the composition.

Generally, the suspending agent is present in the present composition in an amount of from 0.001 percent to 10 percent by weight of the composition. Preferably, the suspending agent is present in an amount of from 0.01 percent to 5 percent by weight based on the weight of the composition. More preferably, the suspending agent is present in a amount of from 0.1 percent to 2 percent by weight based on the weight of the composition.

The composition of the present invention includes at least one or more self-foaming or lathering-generating agents because, the self-foaming agent imparts to the composition a foam property with minimal outside mechanical energy required. The self-foaming agent can provide the ultimate composition with positive pressure for ease of dispensing from a package or may have no positive pressure for greater versatility in choice of packaging materials. The lather-generating agent useful in the present invention can be, for example, a hydrocarbon or other suitable materials.

The self-foaming agent may comprise at least one aliphatic hydrocarbon fluid which is a liquefiable gas or a gaseous hydrocarbon at room temperature. The gaseous hydrocarbon is preferably selected from propane, isobutane, butane, and neopentane. The self-foaming agent may further comprise at least one non-polar liquid which is substantially insoluble in water for the purpose of modifying the vapor pressure of the hydrocarbon fluid. Numerous water-insoluble non-polar liquids are described in detail in McCutcheon's "Functional Ingredients", 1991.

"Substantially insoluble" as used herein means liquids which are less than about 0.1 percent by weight soluble in water.

The water-insoluble non-polar liquid useful as a vapor pressure modifier may be, for example, a substantially water-insoluble, nonvolatile silicone oil. The silicone oil includes, for example, polyalkylsiloxanes, polyarylsiloxanes, polyalkyarylsiloxanes, polysiloxane gums, dihydroxypolysiloxane, and polyethersiloxane copolymers.

The water-insoluble non-polar liquid may also be an ester, such as a glyceride, for example, peanut oil, or a simple ester, for example, butyl stearate or C_{12} - C_{15} alcohols benzoate which is sold under the tradename Finsolv TN by Finetex, Inc., or an ethoxylated and/or propoxylated ester such as PEG-15 distearate, or a polyglyceryl ester such as polyglyceryl-10 dioleate.

The water-insoluble non-polar liquid is preferably an aliphatic hydrocarbon which exists as a liquid at room temperature, or is a liquid hydrocarbon. Illustrative but not limiting of the liquid hydrocarbons include, for example, isopentane, pentane, n-hexane, isohexane, 2,3-dimethylbutane, and mineral oil.

The vapor pressure of the aliphatic hydrocarbon fluids is primarily responsible for the vapor pressure of the composition. It has been found that higher the vapor pressure of the

composition, the more rapidly the lather develops, but the composition may also be dispensed as a foam. It is useful for the purposes of the present invention that the composition be substantially free from foaming, and is a liquid before and at the time of dispensation. The hydrocarbons may be so selected as to provide a composition exerting a positive pressure above atmospheric pressure at least at about 1.6°C. It is preferred that the compositions exert a positive pressure at least at about 13°C (55°F). Most preferred compositions are those that exert a positive pressure at least at about 22°C. The choice of suitable hydrocarbons, alone or in combination; the concentration of hydrocarbons in the composition; and the relative ratios of component hydrocarbons if more than one hydrocarbon is used, are therefore, very critical to obtain the composition of the present invention.

The weight ratio of the gaseous hydrocarbon to water-insoluble liquid generally varies in range from 5:95 to 50:50. Preferably the weight ratio of the gaseous hydrocarbon to water-insoluble liquid varies in range from 10:90 to 20:80. The self-foaming agent typically comprises from 1 percent to 20 percent by weight of the composition.

Preferably, the self-foaming agent is a single gaseous hydrocarbon, which is neopentane. It is suitably present in an amount from 1 percent to 5 percent by weight, based on the weight of the composition.

More preferably, the self-foaming agent is a mixture of iso-butane or n-butane and a nonvolatile silicone oil. The nonvolatile silicone oil is preferably dimethicone.

Most preferably, the self-foaming agent is a mixture of at least one gaseous hydrocarbon selected from n-butane and iso-butane and at least one liquid hydrocarbon selected from iso-pentane, n-pentane, 2,3-dimethylbutane, n-hexane, isohexane, and mineral oil. The weight ratio of the gaseous hydrocarbon to liquid hydrocarbon typically varies in range from 0.5:99.5 to 99.5:0.5. Preferably the weight ratio of the gaseous hydrocarbon to liquid hydrocarbon is in the range from 10:90 to 20:80. The most preferred ratio is 20:80.

The self-foaming agent can also be a volatile organic liquid of such a nature and in such amount that, although in liquid form at ambient temperature and having a vapor pressure substantially below atmospheric pressure, its volatilization is capable of being promoted by the combination of the aqueous soap solution and the surface active agent to an extent that a lather is generated in a practical period of time.

The volatile organic liquid is a water-insoluble organic liquid boiling in the range from 25°C to 70°C, but preferably in the range from 35°C to 50°C. Those liquids include saturated aliphatic hydrocarbons having 5 or 6 carbon atoms, such as n-pentane, iso-pentane, n-hexane, iso-hexane, 2,2-dimethyl-butane, 2,3-dimethyl-butane, and 3-methyl-pentane, and completely halogenated hydrocarbons containing 2 carbon atoms such as 1,1,2-trichlorotrifluoroethane. Other organic liquid compounds useful here are described in U.S. Patent No. 4,744,979.

The amount of self-foaming agent used in the composition should not be so low that no foaming effect is obtained yet not be so high that the composition becomes "unstable" that is, the composition should not become a multiphase system or nonhomogeneous. Also, too much of self-foaming agent can provide an unstable foam. High levels of self-foaming agent can also result in a composition that is "harsh", that is, that irritates the skin of consumer or discolors or damages a surface. If a hydrocarbon is used as a self-foaming agent, for example, too much hydrocarbon can make the composition flammable.

Generally, the self-foaming agent is present in the composition of the present invention in an amount of from 0.01 percent to 35 percent by weight of the composition. Preferably, the lather-generating agent is present in an amount of from 0.1 percent to 20 percent by weight based on the weight of the composition. More preferably, the self-foaming agent in the composition is from 1 percent to 10 percent by weight.

The composition of the present invention may also contain minor amounts, such as from 0 to 10 percent by weight, of one or more conventional additional ingredients to impart desired characteristics to the composition. Suitable additives include for example foam supplements, auxiliary thickening agents, humectants, coloring agents, opacifiers, perfumes, dyes, germicidal agents, preservatives, antiseptic agents, antibacterial agents, disinfectants, emollients, humectants, skin conditioners and opacifying agents.

The composition of the present invention may be prepared by simply mixing the base and the self-foaming agent together, and stirring them thoroughly. By base, it is meant all the ingredients except the self-foaming agent.

In one embodiment, the present composition is prepared by using an in-line intimate mixing process using, for example, a static mixer and metering one stream of self-foaming agent into another stream comprising the remaining ingredients of the composition.

In another embodiment, the present composition is prepared by mixing the continuous, aqueous surfactant phase containing the suspensate with the self-foaming agent by shaking mechanically in well known shaking apparatus. While the ingredients of the present invention may be mixed in any suitable order, it is preferred that the self-foaming agent be contacted with the other ingredients in a final step to prevent premature foaming of the compositions. In a preferred process of making the present composition the steps include admixing the suspending agent with water, then adding the surfactant to the mixture followed by adding the hydrophobe to the mixture and then adding the self-foaming agent.

The ingredients used in the present invention can be in any useful form such as liquids, solids, pastes, flake and powder. The self-foaming agent can also be introduced into the composition as a gas. The resultant composition can take the form of a liquid, gel, paste, cream or lotion.

The composition of the present invention is useful for a variety of topical applications including personal cleaning, household cleaning, industrial cleaning as well as

shaving preparations. The composition of the present invention is particularly useful in a shower to be used in lieu of bar soaps and shampoos.

The composition of the present invention is also useful in many other types of cleansing applications for example shining such as wood cleaner, shoe polish, car wash and shine; deodorizing such as carpet cleaner, upholstery cleaner, pet wash; disinfecting such as toilet bowl cleaner, bathroom surface cleaner, and kitchen countertops; protecting such as upholstery, shoe/boot/leather polish, and car protectant; conditioning such as leather cleaner/conditioner; coloring such as car wash and color and shoe polish. Other applications in which the present composition can be used includes auto wash, surgical scrub, shave preparation, abrasive cleaners, oven cleaners, mildew cleaners, leather cleaner/protector, pet care and industrial cleaners.

The composition may be packaged in a pressurized or non-pressurized container depending on the nature of the ingredients used in the composition.

The following examples are illustrative of the composition of the present invention and are not intended as limitation of this invention, many apparent variations of which are possible without departing from the spirit and scope thereof. The stated amounts of the ingredients are parts by weight unless otherwise indicated.

Example 1

A foaming styling conditioner was prepared by combining the ingredients listed in Table I below as follows:

The hydroxyethylcellulose in the amount listed in Table I, was dispersed in water and heated to 70°C. Quaternium 18 and stearamidopropyl dimethylamine lactate was then added to the hydroxyethylcellulose/water mixture (aqueous phase). The C₁₂-C₁₅ alcohols benzoate, PPG-9, cetyl alcohol, stearyl alcohol and phenylpropyl silsesquioxanol in amounts listed in Table I were mixed together in a separate phase at 70°C and then added to the above aqueous phase. The resultant batch was cooled to 35°C and the remaining ingredients listed in Table I were added to the batch. The resulting finished base was cooled to 5°C and then 96.5 percent of the base was blended with 3.5 percent of an 80/20 (w/w) blend of isopentane-/isobutane blend which was also cooled to 5°C.

The resulting conditioner foamed up when applied to the hair and left the hair with good wetcomb and style retention after rinsing out.

Table I

	<u>Ingredient</u>	<u>Example 1 Weight Percent</u>
5	Water	85.2
	Hydroxyethylcellulose	0.3
	Quaternium-18(di-hydrogenated-tallow dimethyl ammonium chloride)	0.5
10	Stearamidopropyl dimethylamine lactate	8
	C ₁₂ -C ₁₅ alcohols benzoate	0.4
	PPG-9	0.1
15	Cetyl alcohol	2
	Stearyl alcohol	1
	Phenylpropyl silsesquioxanol	1.5
	Pentasodium pentetate	0.5
20	Citric acid	0.1
	Fragrance	<u>0.4</u>
	Total	100

25 Examples 2-9

The formulations of Examples 2-9 are described in Table II-V below and were prepared as follows:

30 Water was first added to a beaker. Carbopol (available from B. F. Goodrich) and an oil were premixed to make sure to completely disperse the Carbopol. The mixture of Carbopol/oil was added to water with high shear propeller mixing and mixed until homogeneous. A surfactant was added to the water with reduced speed mixing and mixed until homogeneous. Nuocept C (available from Nuodex) was then added to the mixture. The viscosity and pH of the mixture was adjusted with triethanolamine.

35 The resultant batch was then cooled to 35°C and the remaining ingredients listed in Tables II-IV were added to the batch. The resulting finished base was cooled to 5°C and then

96.5 percent of the base was blended with 3.5 percent of an 80/20 (w/w) blend of isopentane/isobutane blend which was also cooled to 5°C.

The formulation of Examples 2 and 3 in Table II are moisturizing cleansers with sunscreen. The moisturizers were applied to the skin and foamed upon spreading. After rinsing, the compositions left a pleasant moisturized afterfeel, and in the case of Example 2, the deposition of the menthyl anthranilate sunscreen was observed via fluorescence under ultra-violet light.

Table II

10	<u>Ingredient</u>	<u>Example 2 Weight Percent</u>	<u>Example 3 Weight Percent</u>
	Water	83.05	73.39
15	Propylene glycol isostearate	2.31	2.31
	C ₁₀ -C ₃₀ acrylates crosspolymer (carbopol)	0.69	0.69
	Octyl methoxy cinnamate	2	3
	Menthyl anthranilate	0.5	0
20	Quaternium-18 (N,N bis(hydrogenated tallow) dimethylammonium chloride and isopropanol)	0	2
	Ammonium lauryl sulfate	6	10
	Ammonium cocoyl isethionate	4.7	7.86
25	Polymethoxy bicyclic oxazolidine (Nuocept C)	0.2	0.2
	Triethanolamine	<u>0.55</u>	<u>0.55</u>
30	Total	100	100

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The formulations of Example 4 in Table III is a moisturizing cleanser with sunscreen and water proofing polymer additive. The moisturizer was applied to the skin and foamed upon spreading. After rinsing, the composition left a pleasant moisturized afterfeel, and felt less greasy than in the case of Example 2 due to the film forming properties of the water-proofing polymer.

Table III

	<u>Ingredient</u>	<u>Example 4 Weight Percent</u>
10	Water	74.15
	Propylene glycol isostearate	3.1
	C ₁₀ -C ₃₀ acrylates crosspolymer (Carbopol)	0.69
15	Octyl methoxy cinnamate	3
	Acrylates/octylacrylamide copolymer	0.5
	Quaternium-18 (N,N-bis(hydrogenated tallow)dimethylammonium chloride and isopropanol)	0
20	Ammonium lauryl sulfate	10
	Ammonium cocoyl isethionate	7.86
	Polymethoxy bicyclic oxazolidine (Nuocept C)	0.2
	Triethanolamine	<u>0.5</u>
25	Total	100

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The formulations of Example 5-8 in Table IV are examples of improved mild 2-in-1 shampoos. The shampoos were applied to the hair and foamed upon spreading. The shampoos provided excellent wet combing and aesthetic properties when dry.

Table IV

5	<u>Ingredient</u>	<u>Example 5 Weight Percent</u>	<u>Example 6 Weight Percent</u>	<u>Example 7 Weight Percent</u>	<u>Example 8 Weight Percent</u>
	Water	74.64	74.64	76.14	71.35
10	Propylene glycol isostearate	4.31	4.31	3.31	5.1
	C ₁₀ -C ₃₀ acrylates crosspolymer (Carbopol)	0.69	0.69	0.69	0.69
15	Bis(isostearamidopropyl)-2- hydroxy-N1, N1, N3, N3- tetramethylpropyldimonium chloride	2	0	0	0
	1-ethylene-bis(2-tallow-1- methylimidazolinium) methosulfate	0	2	0	0
	Dibehenyl dimethylammonium methosulfate	0	0	1	0
20	Quaternium-18 (N,N- bis(hydrogenated tallow)dimethylammonium chloride and isopropanol)	0	0	0	4
	Dimethicone	0	0	0.5	0.5
25	Ammonium lauryl sulfate	10	10	10	10
	Ammonium cocoyl isethionate	7.86	7.86	7.86	7.86
	Polymethoxy bicyclic oxazolidine (Nuoccept C)	0.2	0.2	0.2	0.2
30	Triethanolamine	<u>0.3</u>	<u>0.3</u>	<u>0.3</u>	<u>0.3</u>
	Total	100	100	100	100

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The formulations of Example 9 in Table V is an example of a three-in-one shampoo conditioning shampoo with styling benefits. The shampoo was used on the hair and foamed upon spreading. The shampoo provided excellent wet combing, made the hair easy to style, and made the style last longer than a 2-in-1 shampoo.

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Table V

	<u>Ingredient</u>	<u>Example 9 Weight Percent</u>
10	Water	73.04
	C ₁₀ -C ₃₀ acrylates crosspolymer	0.6
	C ₁₂ -C ₁₅ alcohols benzoate	3
	Dimethicone	1
15	Phenylpropyl silsesquioxanol	2
	Quaternium-18 (N,N-bis(hydrogenated tallow)dimethylammonium chloride and isopropanol)	2
20	Ammonium lauryl sulfate	10
	Ammonium cocoyl isethionate	7.86
	Polymethoxy bicyclic oxazolidine	0.2
	Triethanolamine	<u>0.3</u>
25	Total	100

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Claims

1. A composition comprising a stable, homogeneous, self-foaming, cleansing suspension containing an aqueous continuous phase comprising:
 - (a) water;
 - (b) an effective amount of at least one suitable surfactant to provide required
 - 5 cleaning and foaming properties to the composition;
 - (c) an effective amount of at least one suitable suspensate; said at least one suspensate comprising (i) at least one hydrophobic carrier material adapted to serve as a carrier for one or more auxiliary active materials, and (ii) at least one hydrophobic auxiliary active material incorporated in said hydrophobic carrier material;
 - 10 (d) an effective amount of at least one suitable suspending agent to suspend an active suspensate to be deposited on a surface to be cleaned; and
 - (e) an effective amount of at least one suitable self-foaming agent to provide self-lathering properties to the composition, whereby the amount of surfactant is minimized or reduced and whereby the amount of suspensate deposited on a surface is maximized.
- 15 2. The composition of Claim 1 wherein the hydrophobic carrier material is at least one auxiliary active ingredient.
3. The composition of Claim 1 wherein the hydrophobic carrier material is selected from the group consisting of a liquid, oil, low melting wax or paste.
4. The composition of Claim 1 wherein the auxiliary active material is soluble,
- 20 dispersible or miscible in the hydrophobic carrier material.
5. The composition of Claim 1 wherein the auxiliary active material is selected from the group consisting of a solid, liquid, oil, low melting wax or paste.
6. The composition of Claim 1 wherein the hydrophobic auxiliary active material is an oil soluble material, or an oil dispersible material.
- 25 7. The composition of Claim 1 wherein the suspensate is compatible with the other ingredients present in the continuous phase.
8. The composition of Claim 1 wherein the surfactant comprises an anionic, cationic, amphoteric, zwitterionic, nonionic surfactant or mixtures thereof.
9. The composition of Claim 8 wherein the anionic surfactant is selected from the
- 30 group consisting of ammonium lauryl sulfate, sodium laureth-2 sulfate and ammonium cocoyl isethionate; the cationic surfactant is the lactic acid salt of stearamidopropyl dimethylamine; the nonionic surfactant is selected from the group consisting of lauramide DEA, and cocamide MEA and cocamidopropyl amine oxide and the amphoteric surfactant is selected from the group consisting of lauroamphodiacetate and sodium C₁₂₋₁₅ alkoxypropyl iminodipropionate.
- 35 10. The composition of Claim 1 wherein the suspending agent is selected from the group consisting of C₁₀-C₃₀ acrylates cross polymer and hydroxyethyl cellulose.

11. The composition of Claim 1 wherein the hydrophobic carrier material is selected from the group consisting of a silicone oil, an ester, a liquid aliphatic hydrocarbon, a fatty acid and a fatty alcohol.
12. The composition of Claim 11 wherein the silicone oil is dimethicone, the ester is propylene glycol monoisostearate, the liquid aliphatic hydrocarbon is mineral oil, the fatty acid is oleic acid, and the fatty alcohol is stearyl alcohol.
13. The composition of Claim 6 wherein the at least one oil soluble material is selected from the group consisting of bis(hydrogenated tallow)dimethylammonium chloride, acrylates/octylacrylamide copolymer, octyl methoxycinnamate, and phenylpropyl silsequioxanol.
14. The composition of Claim 6 wherein the at least one oil soluble material is a therapeutic agent.
15. The composition of Claim 14 wherein the therapeutic agent selected from the group consisting of octyl methoxycinnamate, menthyl anthranilate, salicylic acid and hydrocortisone.
16. The composition of Claim 6 wherein the at least one oil dispersible material is aluminum starch octenyl succinate.
17. The composition of Claim 1 wherein the self-foaming agent is selected from the group consisting of a hydrocarbon such as propane, isopentane, isobutane, butane, pentane, neopentane, non-polar liquids or mixtures thereof.
18. The composition of Claim 1 wherein the water is present in the composition in an amount of from 1 percent to 99 percent by weight of the composition.
19. The composition of Claim 1 wherein the surfactant is present in the composition in an amount of from 0.001 percent to 50 percent by weight of the composition.
20. The composition of Claim 1 wherein the suspending agent is present in the composition in an amount of from 0.01 percent to 10 percent by weight of the composition.
21. The composition of Claim 1 wherein the suspensate is present in the composition in an amount of from 0.001 percent to 50 percent by weight of the composition.
22. The composition of Claim 1 wherein the ratio of the hydrophobic carrier material to the hydrophobic auxiliary active material is from 20:1 to 1:20.
23. The composition of Claim 1 wherein the self-foaming agent is present in the composition in an amount of from 0.01 percent to 35 percent by weight of the composition.
24. A process comprising mixing the following ingredients: water; a surfactant; a compatible suspending agent; a suspensate, said suspensate comprising at least one hydrophobic carrier material and at least one hydrophobic auxiliary active material incorporated into said carrier material; and a lather generating agent to form a stable, homogeneous, self-foaming cleansing composition.

25. The process of Claim 24 wherein the mixing is carried out by combining two streams in-line and passing the streams through a static mixer.

26. The process of Claim 24 wherein the mixing is carried out by shaking the ingredients with a shaking apparatus.

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INTERNATIONAL SEARCH REPORT

Intern. al Application No

PCT/US 95/00340

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 C11D3/18 C11D17/00 A61K7/00 A61K9/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 C11D A61K A01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

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☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

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P,X	WO,A,94 02109 (DOWBRAND) 3 February 1994 see page 6; claims 1-5; examples 13-16 see page 8 ---	1-12, 17-24,26
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